device **136** will be in a low resistance state when the magnetization of layer **138** is saturated in a common direction such as in the direction of arrow **157**.

[**0043**] Referring to **FIG. 1**, one method of making a magnetic head **10** will be described. A blanket coating of nickel, iron or cobalt or combinations thereof are deposited on an insulating substrate. The magnetic stripes are defined by lift-off or subtractive lithography. Electron beam or x-ray lithography will be required to obtain spacing between magnetic stripes, of the order of a 100 Å. The magnetic stripes are then overcoated with a high sputtering yield nonmagnetic metal, for example, copper. The structure is then planarized by sputter etching or removing nonmagnetic metal on top of the magnetic stripes. The sputter etching can be done for example with glancing angle ion beam sputtering.

[**0044**] While it is possible to make the magnetic stripes by lithography, the resulting device would be larger than the minimum lithographic feature size. Another approach for making magnetic head **10** shown in **FIG. 1** is to use structural features which provide magnetic structures of the appropriate size directly as a result of the deposition process. For example, as shown in **FIG. 8**, a vicinal face of a single crystal substrate is used as a seed layer. Semiconductors such as Si, Ge or GaAs are suitable substrates for the growth of Fe, Ni or Co and their alloys. The vicinal face **161** may be formed by cutting and polishing a single crystal substrate at an angle between 1 to 10° away from a major crystallographic plane and then annealing the crystal substrate **162** to produce atomic scale steps **164** through **167** and surfaces **176-180** forming vicinal face **161**. The separation between interplanar steps is determined by the angle of misalignment of vicinal face **161** from a low Miller index plane shown by arrow **175**. Subsequently, magnetic material **170** is deposited under conditions of for example a pressure of 10^{-8} Torr or less and a substrate temperature of at least 100° C. so it only grows at the step. In the early stages of growth, the magnetic material **170** grows as isolated particles along the steps **164** through **167**. At a later stage, the particles begin to coalesce in a direction parallel to steps **164** through **167** but have a greater distance perpendicular or transverse to steps **164** through **167**. Magnetic material **170** may be ferromagnetic material, for examPle, Fe, Co, or Ni or alloys thereof. Substrate **162** may be held at ambient temperature or higher. In this way, an array of parallel magnetic stripes **171** through **174** can be made which is much smaller than the minimum lithographic feature size. Magnetic stripes **171** through **174** are overcoated with a nonmagnetic metal of comparable thickness such as copper. The upper surface of the nonmagnetic metal is planarized so that there are alternating regions of magnetic and nonmagnetic metals on the vicinal face **161**. Magnetic keepers can be deposited through masks generated by conventional lithography at the end of magnetic stripes **171** through **174**. The magnetic keepers should have a lower spontaneous magnetization and/or thickness so that the total magnetic flux carried by the magnetic keeper is approximately one half the flux carried by the respective magnetic stripes **171** through **174** even though the magnetic stripes may have a very different cross sectional area.

[**0045**] A magnetic head has been described transverse to the long axis of the magnetic stripe and a means for measuring the electrical resistance of the current flowing through the plurality of magnetic stripes upon the application of the magnetic field which may be 30 Oe or less to the magnetic stripe.

[**0046**] Further, a method for fabricating a magnetic head has been described comprising the steps of orienting, cutting and polishing or selecting a single crystal substrate having a surface at an angle between 1 and 100 away from a major crystallographic plane, annealing the crystal to produce atomic scale steps on its surface, depositing a ferromagnetic metal such as Fe, Co, or Ni or alloys thereof onto the single crystal substrate surface with the substrate held at ambient temperature or higher, overcoating the ferromagnetic metal with a nonmagnetic metal of comparable thickness and planarizing the nonmagnetic metal to form alternating regions of magnetic and nonmagnetic metals on the surface of the substrate.

[**0047**] While there has been described and illustrated a magnetic head for sensing a magnetic field by the giant magnetoresistive effect (GMR), it would be apparent to those skilled in the art that modifications and variations are possible without deviating from the broad scope of the invention which shall be limited solely by the scope of the claims appended hereto.

1-25. (Cancelled)

26. An apparatus for sensing a magnetic field by the giant magnetoresistive effect comprising:

a substrate;

a layer of ferromagnetic material formed over the substrate, the layer of ferromagnetic material having a plurality of nonmagnetic regions formed therein whereby magnetic flux paths form around each one of the plurality of nonmagnetic regions when the layer of ferromagnetic material is not in a magnetic field, the flux paths being contained completely with the layer of ferromagnetic material and not penetrating into the plurality of nonmagnetic regions, and

means for detecting a change in resistance through the layer of ferromagnetic material as a function of a magnetic field applied to the layer of ferromagnetic material.

27. The apparatus of claim **36** wherein each of the plurality of nonmagnetic regions has dimensions less than about 350 nm.

28. The apparatus of claim **36** wherein:

the layer of ferromagnetic material is formed from nickel, cobalt or alloys thereof, and

the plurality of nonmagnetic regions is formed by diffusing germanium or silicon into the layer of ferromagnetic material.

29. A method for fabricating a magnetic field sensor comprising:

providing a single crystal substrate having an exposed surface at an angle between 1 to 10 degrees away from a major crystallographic plane;

annealing the single crystal substrate to form an annealed single crystal substrate having a series of atomic scale steps on the exposed surface;

forming upon the series of atomic scale steps a corresponding series of separated magnetic material stripes;